NASA STTR 2016 Phase I Solicitation

T11.01   Information Technologies for Intelligent and Adaptive Space Robotics

Lead Center: ARC

The objective of this subtopic is to develop information technologies that enable robots to better support space exploration. Improving robot information technology (algorithms, avionics, software) is critical to improving the capability, flexibility, and performance of future NASA missions. In particular, the NASA "Robotics, Tele-Robotics, and Autonomous Systems" roadmap (TA04) indicates that extensive and pervasive use of robots can significantly enhance exploration missions that are progressively longer, complex, and operate with fewer ground control resources.

The performance of space robots is directly linked to the quality and capability of the information technologies that are used to build and operate them. Thus, proposals are sought that address the following technology needs:

- Advanced robot user interfaces that facilitate distributed collaboration, geospatial data visualization, summarization and notification, performance monitoring, and physics-based simulation. The primary objective is to enable more effective and efficient interaction with robots remotely operated with discrete commands or supervisory control. Note: proposals to develop user interfaces for direct teleoperation (manual control) are not being solicited and will be considered non-responsive.
- Navigation systems for mobile robot (free-flying and wheeled) operations in man-made (inside the International Space-Station) and unstructured, natural environments (Earth, Moon, Mars). Emphasis on multi-sensor data fusion, obstacle detection, and proximity ops. The primary objective is to radically and significantly increase the performance of mobile robot navigation through new sensors, avionics (including COTS processors for use in space), perception algorithms and software. Proposals for small size, weight, and power (SWAP) systems appropriate for quad-copters, Astrobee/SPHERES free-flying robots, and Spirit/Opportunity scale rovers are particularly encouraged.
- Robot software systems that support adaptive autonomy, automated instrument/sensor targeting, payload data triage, and planning. The primary objective is to facilitate the creation, extensibility and maintenance of complex robot systems for use in the real-world. Proposals that address autonomy for planetary rovers operating in rough terrain or performing non-traditional tasks (e.g., non-prehensile manipulation) are particularly encouraged.

Deliverables to NASA:

- Identify scenarios and use cases.
- Define specifications based on design trades.
- Develop concepts to address use cases.
- Build, test, and demonstrate prototype sub-systems or systems.
- Deliver prototypes to NASA.